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Online coupling of thermal-optical and ^{14}C AMS analysis in atmospheric aerosols source apportionment

Radiocarbon (^{14}C) is a powerful tool that allows the distinction of fossil and non-fossil sources of atmospheric carbonaceous aerosols. The total carbon fraction and its sub-fractions organic carbon (OC) and elemental carbon (EC) comprise a significant portion of the atmospheric fine air particulate matter, influencing the global climate and human health. The separation of OC and EC for ^{14}C measurement is performed with a commercial thermo-optical aerosol analyzer that transforms thermal degradation products into gaseous carbon dioxide. Currently, these gas fractions are then analyzed for ^{14}C with the accelerator mass spectrometry (AMS) system MICADAS either offline (i.e. by sealing of ampules) or by trapping with a zeolite molecular sieve and direct transfer. Although these techniques have been frequently applied with success, they suffer from a loss of information by mixing, as both fractions, OC and EC, comprise many individual chemical compounds. Therefore, we present here the development of a continuous-flow AMS analytical hyphenation. This approach allows for real-time ^{14}C AMS analysis of carbonaceous aerosol samples, as they evolve sequentially from the thermo-optical aerosol analyzer according to their volatility and refractivity.